COBRA Science Olympiad Invitational 2017

Dynamic Planet Test

Name(s):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Team Number:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

School:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Do not open your test packet until you are told to do so by the event supervisor. Only answers recorded on the answer document will be scored. You have 50 minutes to complete the exam. Good luck.

Multiple choice questions (1 pt. each). Please choose one answer for each question. Record your answers on the answer document or they will NOT be scored.

1. Which type of magma has the highest viscosity due to its high silica content:
2. Basaltic magma
3. Rhyolitic magma
4. Andesitic magma
5. Ophiolitic magma
6. When seismic waves pass across the boundary between two different materials, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
7. the waves refract
8. the waves reflect
9. the velocity of the waves changes
10. all of the above
11. Which of the following statements about the Moho is FALSE?
12. Seismic waves speed up as they pass across the Moho heading downward.
13. The Moho separates denser rocks below from less dense rocks above.
14. The Moho marks the top of a partially molten layer.
15. The Moho separates the crust from the mantle.
16. After melting of a continental ice cap, the surface of the continent will tend to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This is an example of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
17. rise; isostasy
18. sink; hypsometry
19. sink or rise depending on the thickness of the ice cap; subduction
20. remain the same as ice doesn’t weigh that much; seismicity
21. What drives plate tectonics?
22. Erosion
23. Thermal conduction
24. Thermal convection
25. Solar energy
26. Which of the following statements is true?
27. The Earth’s magnetic poles are aligned with the Earth’s rotation axis.
28. The Earth’s magnetic poles are inclined approximately 11 degrees from the Earth’s rotation axis.
29. The Earth’s magnetic poles are inclined approximately 23.5 degrees from the Earth’s rotation axis.
30. The Earth’s magnetic poles are perpendicular to the Earth’s rotation axis.
31. Which of the following rock types would be most likely to record the magnetic field of the Earth at the time the rock formed?
32. An alluvial conglomerate
33. A schist
34. An evaporite deposit of halite
35. A basaltic lava flow
36. Which one of the following term associations is FALSE?
37. Asthenosphere: plastic behavior
38. Lithosphere: rigid solid
39. Outer core: rigid solid
40. Continental crust: rigid solid
41. Which one of the following lists most accurately describes oceanic crust?
42. Basaltic with a density of ~3.0 g/cm3
43. Granitic with a density of ~3.0 g/cm3
44. Quartz arenites with a density of ~2.6 g/cm3
45. Basaltic with a density of ~2.3 g/cm3
46. The continental crust consists mainly of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
47. granitic rocks
48. basaltic rocks
49. ultramafic rocks
50. gabbroic rocks
51. The boundary between the Earth’s crust and mantle was first revealed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and is nicknamed the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ after the Croatian seismologist who discovered it.
52. Detailed geologic mapping; Moho
53. Paleomagnetic studies; Soho
54. Analyzing seismic waves; Moho
55. Deep continental drilling; Soho
56. Which of the following statements regarding the inner core is true?
57. P waves do not travel through the inner core
58. P waves travel through the inner core at a higher velocity than S waves travel through the inner core
59. The inner core is thought to be liquid
60. Primary S waves (those generated at the focus of an event) travel through the inner core
61. A group of related rocks that formed together in one area, do not show any relationship to the other rocks around them, and are separated from the rocks around them by [faults](https://commons.wvc.edu/rdawes/CourseInfo/glossary.html#fault) is called a(n)…
62. Craton
63. Subsidence zone
64. Terrane
65. Alluvial fan
66. Which type of plate boundary occurs along mid-ocean ridges and continental rift zones?
67. Transform
68. Divergent
69. Convergent
70. Destructive
71. The driving force of all mass wasting is \_\_\_\_\_\_\_\_\_\_\_.
72. Erosion
73. Insolation
74. Sand
75. Gravity
76. A continent-sized "raft" of low density [felsic](http://jersey.uoregon.edu/%7Emstrick/AskGeoMan/geoQuerry11.html) rock (commonly granite) which has been purified by the earth and accumulated at the surface is a(n)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
77. Craton
78. Aulocogen
79. Superterrane
80. Limestone
81. Which one is not considered an example of mass wasting?
82. Landslide
83. Alluvial fan
84. Mudflow
85. Creep
86. This is an inclusion of mafic crust which gets caught in the accretion processes of a craton and becomes wedged between sections of granite.
87. Accretion belt
88. Orogenic belt
89. Greenstone belt
90. Platform
91. Which term denotes the original rupture point of an earthquake?
92. Epicenter
93. Epizone
94. Fault point
95. Focus
96. Due to activity at the Mid-Atlantic Ridge, the distance between the Eurasian plate and the North American plate is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at a rate of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
97. Decreasing; 2cm/yr
98. Decreasing; 2m/yr
99. Increasing; 5cm/yr
100. Increasing; 2 cm/yr
101. Deep ocean trenches are most abundant around the rim of which ocean basin?
102. Pacific
103. Atlantic
104. Indian
105. Arctic
106. Subduction zone volcanism typically produces this type of volcano. An example is Mount Rainier in Washington.
107. Compound or complex volcano
108. Shield volcano
109. Composite or stratovolcano
110. Cinder cone volcano
111. What is the study of rock relationships within a time-stratigraphic framework of related facies bounded by unconformities?
112. Time-lithostratigraphic facies
113. Sequence deformation
114. Sequence stratigraphy
115. None of the above

The following questions are short answer (2 pts. each). Record your answers on the answer sheet or they will NOT be scored.

24. Harry Hess and Robert Dietz developed the idea of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to explain mid-ocean ridges.

25. This scientist theorized that mantle convection explained the theory of Continental Drift.

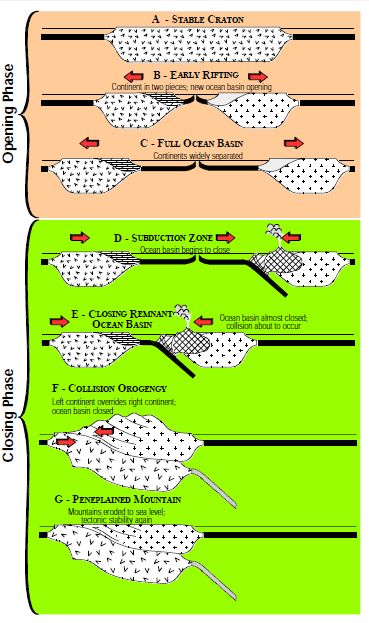
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. (Full name)

26. Name two tectonic plates that are a good example of a constructive plate margin.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plate and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plate.

27. This geologic submarine feature forms behind an island arc from [tensional forces](http://www.wow.com/wiki/Tension_%28physics%29) caused by [oceanic trench](http://www.wow.com/wiki/Oceanic_trench) rollback and the collapse of the edge of the continent during subduction of one crust under the other.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.



28. The above diagram is a description of the…

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

29. The Earth's terrestrial surface or continents are made up of three types of landscapes. Name two of them.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

30. Name the former late Paleozoic supercontinent.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

31. What is the term for the tendency of a foundation material to lose its internal cohesion and to fail mechanically during earthquake shaking?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

32. What is the failed arm of a triple junction rift system called?

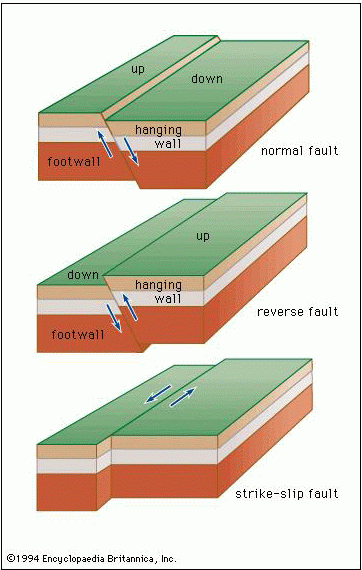
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

33. Usually found between orogenic belts and cratons in fault troughs bounded by low-permeability bedrock, these geologic features are partly filled by unconsolidated and semi consolidated deposits which are fine to coarsely grained particles chiefly of glacial origin. Name them.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

34. Due to the tensional stress responsible for normal faults, they often occur in a series, resulting in the down-dropped blocks forming\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the uplifted blocks forming \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

For the following question refer to the diagram below.



B

C

A

35. Name the different types of faults (3 pts.)

For questions 36-40 match the letter of the diagram to the correct term (5 pts.) Record your answers on the answer document or they will NOT be scored.

|  |  |
| --- | --- |
| 36. Syncline | A. Anticline diagram |
| 37. Dome | B. Basin diagram |
| 38. Anticline | Monocline diagram  C. |
| 39. Basin | D.Dome diagram |
| 40. Monocline | Syncline diagram  E. |

For questions 41-43, refer to the diagram below. Record your answers on the answer document or they will NOT be scored. You may use the scratch paper provided.

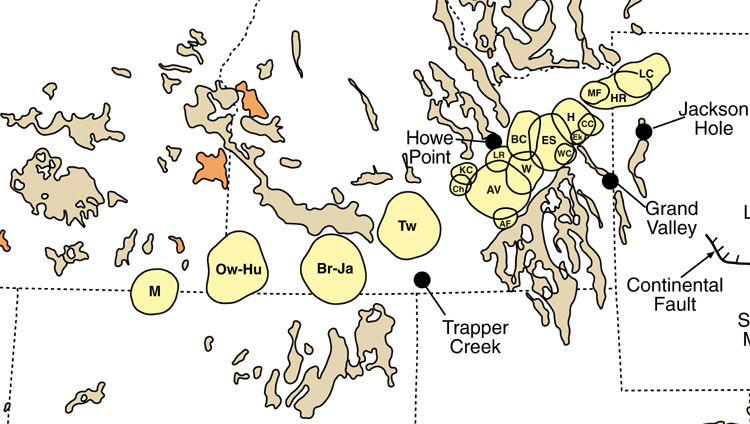


Figure of western U.S showing the track of the Yellowstone hotspot as assumed by younging in a northeast direction of silicic calderas (yellow).

|  |  |
| --- | --- |
| **Snake River Plain - Yellowstone Eruptive Centers** | |
| **LC** = 0.60 Ma Lava Creek Tuff   **MF** = 1.29 Ma Mesa Falls Tuff   **HR** = 2.00 Ma Huckleberry Ridge Tuff   **H** = 4.49 Ma tuff of Heise   **Ek** = 5.37 Ma tuff of Elkhorn Springs   **WC** = 5.81 Ma tuff of Wolverine Creek   **CC** = 5.94 Conant Creek Tuff   **BC** = 6.19 Ma tuff of Blue Creek   **W** = 6.19 Ma Walcott Tuff   **ES** = 6.57 Ma tuff of Edie School | **AF** = 7.48 Ma tuff of America Falls   **KC** = 9.17 Ma tuff of Kyle Canyon   **LR** = 8.75 Ma tuff of Lost River Sinks   **Ch** = 9.34 Ma tuff of Little Chokecherry Canyon   **AV** = 10.09 Ma and 10.27 Ma tuff of Arbon Valley A & B   **Tw** = 8.6 to10 Ma Twin Fall Caldera   **Br-Ja** = 10.0 to 12.5 Ma Bruneau-Jarbridge Caldera   **Ow-Hu** = ~13.9 to 12.8 Ma Owyhee-Humbolt Caldera   **M** = 16.1 Ma McDermitt Caldera |

41. The distance from the McDermitt Caldera to the tuff of American Falls is approximately 362 km. Calculate the speed of the North American plate as it moves over the hotspot in **cm**/yr. Please round to nearest hundredth. (4 pts.)

42. The distance from the tuff of American Falls to the Lava Creek Tuff is approximately 315 km. Calculate the speed of the North American plate as it moves over the hotspot in **cm**/yr. Please round to the nearest hundredth. (4 pts.)

43. From your calculations, is the plate speed increasing or decreasing? Knowing what you know about plate tectonics, give one reason why this might occur. (3 pts.) Use 1-2 complete sentences.

The next questions concern earthquakes and their epicenters. Place your answers for the chart beside the corresponding numbers on your answer sheet. Lag time is in seconds. (1pt. each)

|  |  |  |  |
| --- | --- | --- | --- |
| Recording Station | P-wave arrival time | S-wave arrival time | Lag Time |
| Los Angeles | 11:06-06 PST | 11:06-19 PST | 44. |
| San Francisco | 11:06-46 PST | 11:07-18 PST | 45. |
| Salt Lake City | 12:08-06 MST | 12:09-22 MST | 46. |
| Albuquerque | 12:08-45 MST | 12:10-15 MST | 47. |

48. Assuming an average velocity of 3.80 miles/second for the P-waves, how long does it take for them to travel 100 miles? (Round to the nearest second; 2 pts.)

49. Assuming an average velocity of 2.54 miles/second for the S-waves, how long does it take for them to travel 100 miles? (Round to the nearest second; 2 pts.)

50. What is the lag time associated with 100 miles? (1pt.)

Now determine the distance from each of the four seismograph stations to the epicenter of the earthquake. Round up or down to the nearest mile (1 pt. each). Distance may be computed by proportion, using the lag time value for 100 miles that you obtained in Problem 50. Distance= lag time velocity X time. (Velocity=distance/time)

|  |  |
| --- | --- |
| Recording Station | Distance from epicenter in miles |
| Los Angeles | 51. |
| San Francisco | 52. |
| Salt Lake City | 53. |
| Albuquerque | 54. |

55. Which city is closest to the earthquake’s epicenter? (1 pt.)